English books, followed by a discussion of all the ordinary simple machines—with this difference, that Herr Stephan's figures are much better than those of our text-books. Then follows a discussion of friction, in which, although the author almost invariably solves his problems by introducing the normal force N and the friction μN, he does not omit to point out the utility of the *total resistance* and the angle of friction. He underestimates this utility, however, in solving a simple problem by the N and μN method, and in his final results (p. 118) substituting the angle of friction —a process which simply obscures the merit of the second (and much shorter) method—with the remark that the example shows the advantage which the introduction of the angle of friction "occasionally offers." The truth is that in the hands of a skilful student the geometrical method founded on the employment of the angle of friction and the total resistance is almost always more neat, direct, and simple than the analytical, or N and μN, method. It can be conceded, however, that for engineering students, and technical students generally, this analytical method is the safer, although the longer, and requires less of the *esprit mathématique*. The nature of rolling resistance, which seldom finds mention in our English books, is well explained and illustrated by several applications (pp. 147, &c.). Indeed, the whole of Herr Stephan's treatment of the machines (screw presses, cranes, friction band-brakes, &c.) commonly discussed is excellent, and occupies a very large part of the treatise; it is, in fact, the best and most useful portion of the book.

The only kind of catenary treated of in this volume is the parabola of suspension bridges, to which only two pages and two illustrative examples are devoted. Doubtless the subject will receive more consideration in some subsequent volume.

Herr Stephan is very careful to avoid errors in his figures, and to represent the lines of action of three forces when they keep a body in equilibrium as meeting in a point—a very elementary condition not always observed in our text-books. Once, however, he overlooks this necessity, and represents the lines of action of three forces acting on a bar in a framework (Fig. 164) as forming a triangle of very respectable area.

In the section dealing with the equilibrium of frameworks of jointed bars, he directs attention to the obvious fact, which is not usually mentioned in our books, that even if the bars are loaded throughout their lengths (by their own weights or otherwise) the stresses can be calculated by taking any of the bars as unloaded and weightless, and then superposing the calculated results (p. 197). This simple principle he applies in a special case, and it is one which on many occasions might be employed with great advantage.

The last hundred pages are devoted to kinetics of an elementary kind—including the theory of direct collision of spheres, the compound pendulum, &c.—together with a section on the moments of inertia of various figures and solids. There is no mention made of the very simple and useful rule that a triangular area can be replaced by three equal particles placed at the middle points of its sides—a rule which saves an enormous amount of trouble in the calculation of moments of inertia for all plane areas bounded by right lines. In the absence of this simple rule, a ponderous application of the integral calculus is the only refuge of the student. A somewhat similar "particle rule" saves reams of ponderous calculus work in hydrostatics; but these rules are not widely known.

Herr Stephan very properly makes short work of D'Alembert's principle, deducing it directly from Newton's axioms ii. and iii., so that, although he employs the term "centrifugal force," he is careful, except in one instance, to show that it is a force exerted *by*, and not *on*, a moving particle. The exceptional instance occurs at p. 281, where he is calculating the tension in a driving belt which passes over the surfaces of two revolving cylinders. Here he speaks of a small element of the band as "experiencing" a centrifugal force, which is duly represented, in the usual way, by a centre-flying arrow. His subsequent teaching, however, removes the erroneous notion herein contained.

The book is wonderfully well printed and illustrated, as well as free from mistakes. On p. 15 "Punkte" should clearly be "Kräfte," and on p. 187 the reference should be to Fig. 131 and not to Fig. 135. The theory is illustrated by nearly 200 examples.

To all students who desire to attain a real and physical conception of the subject Herr Stephan's work can be very strongly recommended.

GEORGE M. MINCHIN.

OUR BOOK SHELF.

Machine Drawing. By Alfred P. Hill. Pp. 83. (London: P. S. King and Son, 1904.) Price 2*s*. 6*d*. net.

IN this text-book the author presents a course of instruction which he considers suitable for students attending elementary drawing classes who are unable to spare more than one evening per week, and whose technical training is thus confined to the one subject of machine drawing. Three dozen plates are given, affording a choice of examples to be copied to scale from the dimensions figured, some of which are proportional dimensions covering a range of sizes. Accompanying the plates are descriptive accounts of the construction and uses of the machine parts drawn, with sets of questions founded thereon. At intervals, where space is available, formulæ and physical data are introduced and used in making calculations illustrating machine design. This crude attempt to teach applied mechanics along with elementary machine drawing seems to us a mistake, as, in the absence of a knowledge of mechanical principles, such formulæ as are given become mere rules of thumb, and any attempt to apply them independently cannot fail to be disastrous, as, for instance, in the author's method of estimating the limiting speed of a fly-wheel on p. 42. The time wasted on these premature calculations might very profitably be spent with rule, callipers, and squared paper, in measuring and making careful and complete dimensioned sketches of actual machine parts, and so cultivating the habit of closely and accurately observing constructional details.

Errors abound throughout the book. The author is not a safe guide even in such a small detail as the projection of a hexagonal nut, while his statement on p. 44 that "heat and work are mutually controvertible" is a fair index of the scientific value of the work. The volume is somewhat redeemed by a few

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good plates prepared from working drawings supplied by makers, but in many cases the figures indicating dimensions are, unfortunately, so small as scarcely to be legible.

An Elementary Class-book of Practical Coal-mining. By T. H. Cockin. Pp. xii+428. (London: Crosby Lockwood and Son, 1904.) Price 4*s.* 6*d.* net.

IN general character this useful volume resembles the text-books already available for students of coal-mining. The work is, however, carried to a rather more advanced stage than has hitherto been considered necessary for an elementary class-book, and chapters are given dealing with allied subjects, such as chemistry, mechanics, the steam-engine, and electricity. The order of treatment differs from that usually adopted, the subjects dealt with being:—(1) geology; (2) structure of stratified rocks; (3) coal and coalfields; (4) search for coal; (5) sinking; (6) opening out; (7) miners' tools; (8) explosives; (9) methods of work; (10) working by long wall; (11) methods of working by pillar and stall; (12) special methods of work; (13) timbering; (14) coal cutting by machinery; (15) mechanics; (16) steam; (17) gases; (18) ventilation; (19) instruments; (20) lighting; (21) winding; (22) haulage; (23) pumping; (24) surface arrangements; (25) coke making; (26) accidents; and (27) electricity. This arrangement is not so logical as that adopted by the late Sir C. Le Neve Foster in his elementary work. For example, sinking with rock-drills is described before mining tools, coal-cutting machinery before the elements of mechanics, and electric signals before electric terms are defined. The brief chapter on coke making is hardly necessary, as this subject is usually dealt with in metallurgical treatises. It is doubtful, too, whether the chapters on chemistry, mechanics, steam, and electricity are sufficiently full to give an insight into the allied subjects, for the study of which excellent text-books are available. The illustrations are clear and diagrammatic, and possess the advantage of having been specially drawn for the book.

Bird Notes from the Nile. By Lady William Cecil. Pp. xii+113; illustrated. (London: Archibald Constable and Co., Ltd., 1904.) Price 2*s.* 6*d.* net.

THREE claims to high commendation present themselves on the first glance at this elegant little popular work. In the first place, the numerous illustrations are simply exquisite; secondly, technical names are banished from the text; and, thirdly, in the long list of species forming the appendix such names appear to be correctly spelt, and are thoroughly up to date, even to the adoption of the so-called "Scomber scomber" system of alliteration. In her preface Lady William confesses that the notes were written originally solely for her children, who doubtless were desirous of possessing a memento of their parents' Nile trip, but that friends persuaded her to offer them to the public. The adoption of this advice is, in our opinion, fully justified, and while the book has no doubt been found delightful by the young people of the family, it can scarcely fail to be a pleasant companion to the many bird-lovers who make a winter excursion up the Nile. Although no attempt (and very properly) is made at technical descriptions of the various species encountered during the voyage, such notes as are given are in most cases sufficient to render identification an easy matter, to say nothing of the instances when this is rendered self-evident by the illustrations.

R. L.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Education and National Efficiency in Japan.

THE notice of my book "Dai Nippon, the Britain of the East," which appeared in NATURE of December 1, directed attention to a nation from which much may be learnt at the present time, and it may interest your readers if I supplement your article by a few notes from my personal experience and observation. In the memorandum issued by Sir Norman Lockyer suggesting the formation of a British Science Guild, it is stated that the people of this country do not manifest that interest in and belief in the power of science which are noticeable among the peoples of the Continent or of America, and that, in spite of the efforts of many years, the scientific spirit essential to all true progress is still too rare, and, indeed, is often sadly lacking in some of those who are responsible for the proper conduct of many of the nation's activities. The British Science Guild has been proposed with the view of attempting to remedy this evil, and to bring home to all classes the necessity of applying scientific treatment to affairs of all kinds.

The objects of such a guild have been attained, to a very remarkable degree, in Japan, not so much by the formation of a special organisation for the purpose, as by the awakening of the national consciousness to the necessity of keeping in mind certain definite aims, and by the earnest cooperation of the various departments of Government, of scientific associations, and of private organisations of many different kinds. There is, indeed, a danger at the present time in this country of too much importance being attached to mere organisation and machinery, and too little to the spirit which pervades them. Mr. Matthew Arnold, in one of his last official reports on elementary schools, pointed out that "our existing popular school was far too little formative and humanising, and that much of it to which administrators point as valuable results is in truth mere machinery." This applies with far greater force to a great deal which has been done in recent years in the way of scientific and technical education. Instruction and knowledge are too often confounded with education, and mere machinery and organisation prevent the development of the scientific spirit. Many of the men who are supposed to have had a complete technical education are very poor specimens of humanity, wanting in individuality and character, devoid of all originality, and with a very narrow view of the world. Some of them may manage to pile up fortunes for themselves, but they will do little to make their country great. Even from a practical point of view, success in any trade or profession does not depend so much on the amount of information which may have been crammed into the learners' heads as is often supposed. It depends incomparably more upon their capacity for useful action than upon their acquirements in knowledge. All experience proves that the spiritual is the parent and first cause of the practical, and especially the economic history of the Middle Ages shows us that an ounce of manly pride and enthusiasm is worth more than a pound of technical skill.

The recent history of Japan has emphasised this fact While attention has been paid to details, the spirit which has animated the leaders of public opinion and action has been the chief cause of the great developments which have taken place. The complete study of this aspect of Japanese national life would take us into many interesting psychological discussions, but it is sufficient for our present purpose to note that the Japanese mind, unlike the British (which is strongly individualistic), is dominated to a very great extent by collective opinion. At the same time, while Japanese philosophy and their former social order were essentially communistic in their nature, still (contradictory as it may seem) their genius is individualistic, and they impress their personal qualities on their work, although they are willing to sacrifice results to a rigid organisation. The outcome of it all is that the national consciousness is

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